

Use on projects with 10,000 tons or greater, for all types of mixes.

460-020

QMP HMA Pavement Nuclear Density.

A Description

Replace standard spec 460.3.3.2 (1) and 460.3.3.2(4) with the following:

- (1) This special provision describes density testing of in-place HMA pavement with the use of nuclear density gauges. Conform to standard spec 460 as modified in this special provision.
- (2) Provide and maintain a quality control program defined as all activities and documentation of the following:
 1. Selection of test sites.
 2. Testing.
 3. Necessary adjustments in the process.
 4. Process control inspection.
- (3) Chapter 4 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required procedures. Obtain the CMM from the department's web site at:
<http://roadwaystandards.dot.wi.gov/standards/cmm/index.htm>

B Materials

B.1 Personnel

- (1) Perform HMA pavement density (QC, QV) testing with nuclear gauges under this provision using HTCP certified Nuclear Technician I operators.

B.2 Testing

- (1) Conform to ASTM D2950 and CMM 4-5-90 for density testing and gauge monitoring methods. Perform nuclear gauge measurements using gamma radiation in the backscatter position. Perform each test for 4 minutes of nuclear gauge count time.

B.3 Equipment

B.3.1 General

- (1) Furnish nuclear gauges from the department's approved product list at <http://www.atwoodsyste.ms.com/materials> that is used for necessary testing (QC, QV). The manufacturer will perform calibration of gauge or an approved calibration service within 12 months of time used on project. Retain a copy of the manufacturer's calibration certificate with the gauge.

B.3.2 Correlation of Nuclear Gauges

B.3.2.1 Correlation of QC and QV Nuclear Gauges

- (1) Select a representative section of the compacted pavement prior to or on the first day of paving for the correlation process. The section does not have to be the same mix design.

- (2) Correlate the 2 or more gauges used for density measurement (QC, QV). The QC and QV gauge operators will perform the correlation on 5 test sites jointly located. Record each density measurement of each test site for the QC, QV and back up gauges.
- (3) Calculate the average of the difference in density of the 5 test sites between the QC and QV gauges. Locate an additional 5 test sites if the average difference exceeds 1 lb/ft³ (16 kg/m³). Measure and record the density on the 5 additional test sites for each gauge.
- (4) Calculate the average of the difference in density of the 10 test sites between the QC and QV gauges. Replace one or both gauges if the average difference of the 10 tests exceeds 1 lb/ft³ (16 kg/m³) and repeat correlation process from B.3.2.1(2).
- (5) Furnish one of the QC gauges passing the allowable correlation tolerances to perform density testing on the project.
- (6) Remove or replace a gauge if it fails to stay within the allowable tolerances set on the reference site. Re-correlation is not necessary if the gauge being used was tested in the original correlation process.

B.3.2.2 Correlation Monitoring

- (1) Establish a project reference site approved by the department. Clearly mark a flat surface of concrete or asphalt or other material that will not be disturbed during the duration of the project. Perform correlation monitoring of the QC, QV, and all back-up gauges at the project reference site.
- (2) Conduct an initial 10 density tests using a gauge on the project reference site and calculate the average value to establish a reference value. Use the reference value as a control to monitor the calibration of the gauge for the duration of the project.
- (3) Check the gauges on the project reference site a minimum of one test per day if paving on the project and compare to the reference value. Maintain the reference site test data for each gauge at an agreed location.
- (4) Calculate difference in measured density verses reference values and investigate if the difference exceeds 1.5 lb/ft³ (24 kg/m³). Conduct 5 additional tests at the reference site once the cause of deviation is corrected and record and calculate the average. Remove the gauge from the project if the average exceeds 1.5 lbs/ft³ (24 kg/m³).

B.4 Quality Control Testing and Documentation

B.4.1 Traffic Lanes, Shoulders, and Appurtenances

- (1) Conduct a minimum of 7 random QC nuclear gauge density tests per lot.

- (2) Prior to the start of paving select the frequency of QC testing for each layer of paving and inform the engineer. Maintain the selected frequency for the duration of the project unless approved by the engineer.
- (3) Select QC test site, station and offset distance randomly as specified in CMM 4-5-90 prior to paving and provide a copy to the engineer. Locate and mark QC density test site for each lot prior to performing test. Perform density test prior to open traffic on pavement.
- (4) Calculate pavement density by averaging the nuclear density reading for the selected number of tests for a lot. Additional tests for compaction process control can be taken but not used in calculating pavement density for a lot.
- (5) Document QC density test data as specified in CMM 4-5-90. Provide the engineer the original data sheet for each lot within 24 hours of QC testing completion for that lot.

B.4.2 Side Roads, Crossovers, Turn Lanes, and Ramps (< 750 tons per layer)

- (1) A lot represents a combination of the total combined tonnage for each layer.
- (2) A lot represents a turn lane, crossover, and ramp for each layer.
- (3) Perform the number of tests per lot as specified in Table 1.

| Side Roads, Turn Lanes, Crossovers, Ramps: Lot/Layer tonnage | Minimum Number of Tests Required |
|---|---|
| 25 to 100 tons | 1 |
| 101 to 250 tons | 3 |
| 251 to 500 tons | 5 |
| 501 to 750 tons | 7 |

Table 1

B.4.3 Corrective Action

- (1) Notify the engineer immediately when a lot average density value or individual test is 3.0 percent or greater, below the specified minimum in standard spec 460.3.3.1.
- (2) Remove and replace the area of the layer specified in B.4.3(1) and replace with material that meets the specified minimum density. Determine limits of the area to be removed by measuring density of the layer at 50-foot (15 m) increments both ahead and behind the point of unacceptable density and at the same offset as the original test site. Continue testing 50-foot (15 m) increments until a point of acceptable density is found as specified in standard spec 460.5.2.2(1). Removal and replacement of material may be required if extended testing is in a previously accepted lot. Testing in a previously accepted lot will not be used to recalculate a new lot density.

- (3) Compute unacceptable pavement area using the product of the longitudinal limits of the unacceptable density and the full width of the paver pass, lying in the traffic lane or lanes. Shoulders shall be exempt from this calculation.
- (4) Retesting and acceptance of replaced pavement will be as specified in standard spec 105.3.
- (5) Tests indicating greater than 3.0 percent density below the specified minimum and further tests taken to determine the limits of unacceptable area to be removed, will be excluded from computation of lot density. Test results of the replaced pavement will not be included in the original lot density computations unless the quantity replaced represents 20 percent or greater of the lot quantity.

B.5 Department Testing

B.5.1 Verification Testing

- (1) The department will have an appropriately HTCP certified technician perform verification testing. The department will test randomly at locations independent of the contractor's QC work. The department will perform verification testing at a minimum frequency of 10 percent of the lots and a minimum of one lot per mix design. The lots selected will be within the active work zone and under the contractor's construction traffic control. It is strongly recommended that the same frequency of testing for QC be used for QV. The minimum testing frequency of a QV lot is 7 tests.
- (2) Verification test results that meet required contract density will indicate QC test results are acceptable. Verification average lot test results within 1.5 lb/ft^3 (24 kg/m^3) of the QC average lot test results will indicate the QC test results are acceptable. Verification tests resulting in a difference greater than 1.5 lb/ft^3 (24 kg/m^3) of the QC average lot test result will be resolved with dispute resolution specified in B.6. The engineer will notify the contractor immediately when density deficiencies or testing precision exceeding the allowable differences are observed.

B.5.2 Independent Assurance Testing

- (1) Independent assurance is unbiased testing the department performs to evaluate the department's verification and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform the independent assurance review according to the department's independent assurance program.

B.6 Dispute Resolution

- (1) Investigation of non-correlating QC and QV test results will be conducted to determine cause. Gauges will be checked on the project reference site and if one is found to be out of calibration, the gauge will be removed from the project and the other gauge's test results will be used for material acceptance.

- (2) Continue investigation in the work zone by analyzing testing, calculation, and documentation procedures if the gauges are both in calibration. If the testing discrepancy cannot be identified, the contractor may elect to accept the QV lot density test results or retesting of the lot in dispute within 48 hours of paving. Traffic control costs will be split between the department and the contractor.
- (3) If investigation finds that both gauges are in error, the contractor and engineer will reach a decision on resolution through mutual agreement.

B.7 Acceptance

- (1) The department will accept QMP HMA Pavement Nuclear Density based on the contractor QC tests, unless it is shown through the verification or the dispute resolution process that the contractor's test results are in error.
- (2) The department will not accept QMP HMA Pavement Nuclear Density if a non-correlated gauge is used for contractor QC tests.

C (Vacant)

D (Vacant)

E Payment

- (1) Costs for all sampling, testing, and documentation required under this special provision are incidental to the work. If the contractor fails to perform the work required under this special provision, the department may reduce the contractor's pay. The department will administer pay reduction under the Non-performance of QMP administrative item.

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